Reducing TCO with Dell Telecom Infrastructure Automation Suite User Guide

**Reducing TCO with Dell Telecom
Infrastructure Automation Suite**
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Executive Summary

In an industry grappling with rapid technological evolution and intensifying competition, communications service providers (CSPs) are adopting cloud technologies to gain the benefits of a cloud operating model, which include efficiency, flexibility, and accelerated innovation. However, management of a distributed telecom infrastructure to support this new model presents substantial operational challenges. The present mode of operations (PMO) is characterized by a heavy reliance on manual scripting and engineer-dependent processes that are neither sustainable nor efficient.

This fragmented approach results in significant operational expenditure (OpEx) and hinders the agility of CSPs. The complexity associated with this approach also inhibits the ability to implement a common, horizontal cloud platform, which reduces server utilization rates to drive increased capital expenditure (CapEx).

Dell Telecom Infrastructure Automation Suite introduces a paradigm shift by helping CSPs overcome the complexities of managing the deployment and life cycle of server hardware used in a telco cloud. It replaces the manual scripting and engineer-dependent processes with pre-built blueprints and declarative automation for deploying, updating, and scaling the cloud to meet workload requirements. In a telecom network, there can be tens to hundreds of server parameters that must be configured or monitored to ensure seamless operation over the life cycle of the system. By adding a dedicated software layer that integrates with CSPs' management systems and employs declarative automation to manage configuration and updates, Dell significantly reduces the complexity of delivering infrastructure-as-code. With this software layer in place, CSPs can now achieve the ease-of-use of a public cloud while maintaining the control and cost structure of a private cloud across a large, distributed network.

Dell Telecom Infrastructure Automation Suite drives consistency by enabling CSPs to leverage blueprints that ensure repeatable deployments and upgrades. This consistency eliminates the configuration problems that frequently plague Day 2 operations. It also reduces maintenance overhead by automating update processes and diminishes the dependence on scarce engineering expertise. Dell's Infrastructure Automation was designed with AIOps in mind, aggregating telemetry from the server infrastructure from across the network to enable AI/ML applications to support predictive analytics and advanced fault management.

Strategically, Dell's Infrastructure Automation aims to simplify life-cycle management, integrate a multitude of server vendors, and enhance operational intelligence. Adopting this software not only streamlines the operational processes but also yields significant economic advantages.

Dell has worked with ACG Research to develop a total cost of ownership (TCO) model to assess the impact of Dell Infrastructure Automation in a typical CSP's core network. This paper compares the economic impact of the current PMO against the adoption of Dell Telecom Infrastructure Automation Suite, revealing substantial savings in both OpEx and CapEx. The analysis forecasts a 20% reduction in the five-year cumulative TCO, with a 23% decrease in OpEx and 15% reduction in CapEx, highlighting its potential to revolutionize telecom infrastructure management.

Present Mode of Operations for Infrastructure Management

The management of hardware platforms and container-as-a-service (CaaS) infrastructure is currently fragmented and heavily reliant on custom integrations and manual scripting. This method is characterized by:

- Engineer-Dependent Integrations and Scripts: Varied integration and scripting approaches lead to

inconsistencies in server management.

- Inconsistent Methodologies: Different engineers employ varying approaches, leading to a lack of standardization that leads to potential configuration errors that impact security, performance and reliability.
- Insuicient Discovery and Inventory Processes: Lack of automated processes for server discovery and inventory management makes it difficult to maintain an up-todate view of the health and configuration of the environment.
- Intensive Maintenance: Scripts require ongoing maintenance and updates due to constant changes in hardware and software, including patches, new network interface cards (NICs), BIOS updates and settings, and more.
- Expertise-Dependent: These tasks demand significant engineering knowledge and support, which are costly and scarce.
- Day 2 Challenges: Ensuring server configurations align with cross-subsystem compliance matrices and managing upgrades in a timely manner can be complex and error-prone in diverse as well as distributed infrastructure.
- Complex Multivendor Management: The diverse hardware and CaaS software landscape adds to the complexity, particularly in maintaining consistency and managing day-to-day operations.
- Limited Data for AIOps: AIOps applications promise to simplify Day 2 operations, but they require data on the health, performance, and configuration of the server infrastructure to be effective, which has been hard to aggregate across large, diverse, and distributed networks.

These challenges culminate in a process that is slow, cumbersome, and unsustainable, particularly when considering the accelerating pace of technological advancements in the telecom industry.
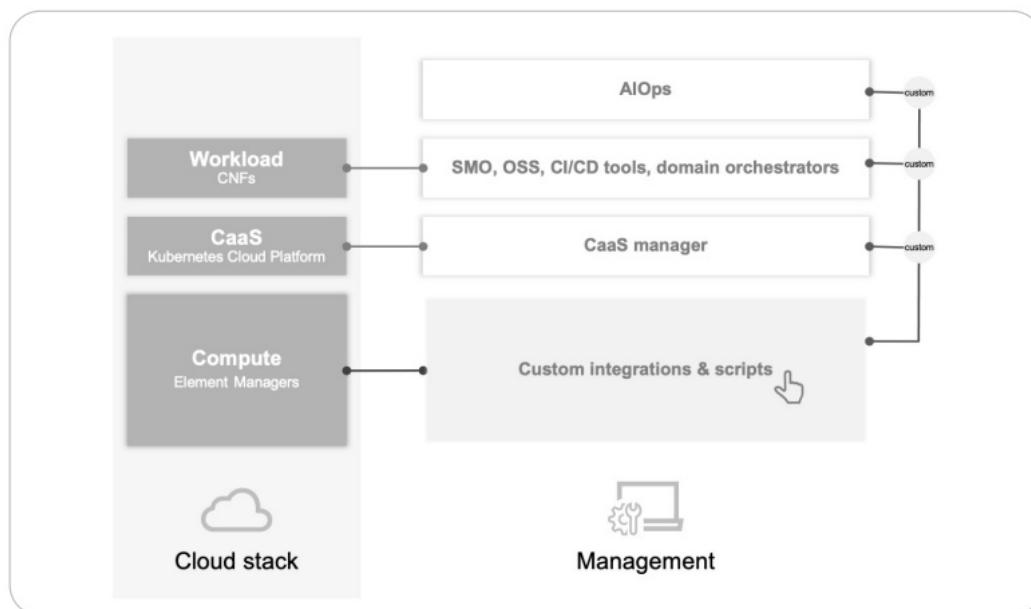An overview of this management architecture is presented in Figure 1.

Figure 1. Current Management Architecture

Dell Telecom Infrastructure Automation Suite

Dell Telecom Infrastructure Automation Suite offers a new approach by introducing a software layer specifically designed to automate the discovery and configuration of industry-standard server infrastructure used in on-premises, multivendor environments. It simplifies server setup and updates by automating server discovery and using declarative automation based on prebuilt workflows to update hardware settings for BIOS, firmware, NIC, RAID, etc., for Dell as well as third-party servers.

It also integrates with cloud platform software, CI/CD toolsets, and domain orchestration managers to enable CSPs to automate the deployment and life-cycle management of entire cloud stack.
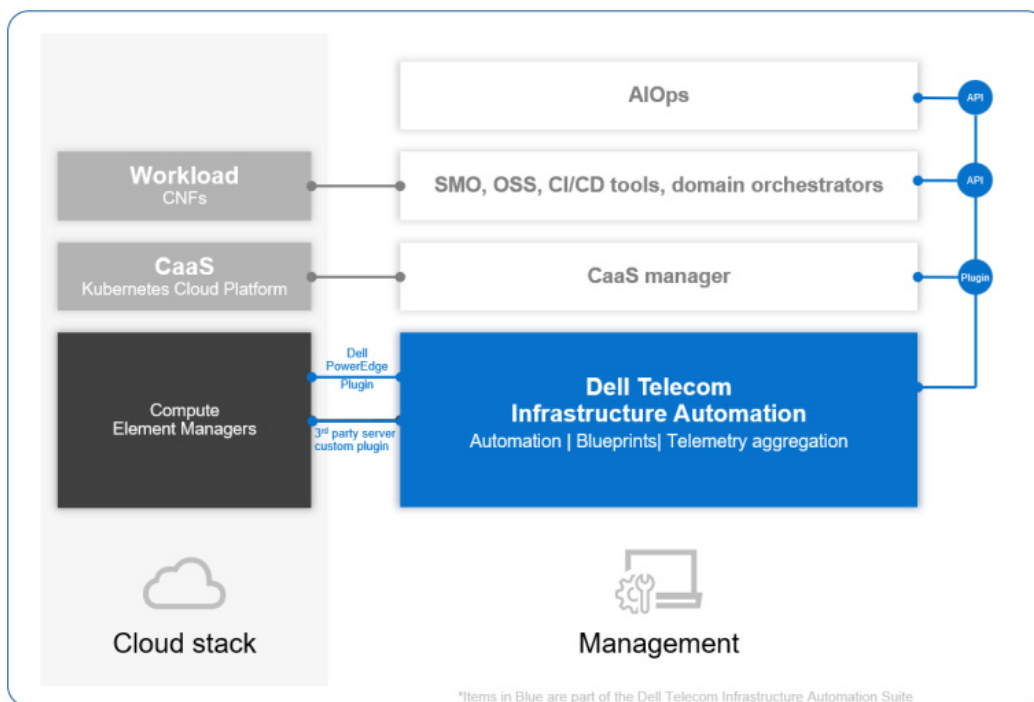

Figure 2. Management with Dell Telecom Infrastructure Automation Suite

Dell's Infrastructure Automation includes APIs and SDKs that can be used by Dell Services, a systems integrator, or an internal engineering team to integrate this new software layer with a CSP's management systems to fully automate the life-cycle management of a disaggregated, cloud-native network.

This software layer reduces the time spent discovering server configurations and eliminates the need for complex, engineering-intensive scripting processes to update server configurations to align with approved configuration profiles. By integrating this software layer with a CSP's GitOps processes, the CSP can automate the process of ensuring all hardware prerequisites are met prior to deploying or updating the cloud or workload software. It does this by maintaining an up-to-date view of the configuration of all servers across the network and utilizing easy to edit, pre-built blueprints and declarative automation to update those servers to align the configuration defined in Git.

This new software layer can reduce the time spent on fault, performance, and configuration management in three ways:

- By integrating with tools, such as Argo Cd which support the ability to automate the detection and remediation of configuration drift, CSPs can eliminate configuration errors that frequently introduce fault and performance issues;

- Automating system rebuild processes to support rapid restoration of services after a faulty component or system has been identified;

- Employing a federated architecture that collects telemetry from all the servers under management to feed fault and performance metrics into AIOps systems that streamline troubleshooting processes and proactively detect issues before they become a problem.

This new software layer also helps accelerate an application developer's workflow by enabling the delivery of infrastructure-as-code. This provides a capacity-on-demand experience like a public cloud with the control and cost structure of a private cloud. By integrating with their CI/CD processes, CSPs can also employ modern test and release management methodologies for rolling out hardware/software updates in a cloud-native environment such as canary deployments with rollbacks for the full hardware and software stack.

The Suite consists of:

- Telecom Infrastructure Automation: Core software that leverages blueprints and declarative automation to update the server configurations, automates deployment of the cloud platform software, and includes rich APIs for integrating with CI/CD pipeline tools, northbound orchestration applications, and southbound infrastructure . It also aggregates fault and performance metrics from all the infrastructure under its management to enrich AIOps applications.
- Plugins: Dell's Infrastructure Automation is extensible through plug-in adapters. There are standard adapters offered with Infrastructure Automation that support Dell PowerEdge servers as well as cloud software platforms such as Red Hat OpenShift and Wind River Studio.
  Custom plugins can be built to support third-party servers and other CaaS suppliers. The creation of custom plugins is supported through APIs and SDKs provided as part of the Foundation. Dell plans to add plugins to support other types of infrastructure beyond servers and CaaS.

Dell, along with SI partners, can offer a full suite of professional services to design, deploy, and help CSPs integrate Dell Infrastructure Automation with their CI/CD, processes, SMO or other domain orchestrator. They also offer blueprinting services and services for creating custom plugins.
The key strategic objectives for Dell's Infrastructure Automation are:

- Life-Cycle Management Simplification: From provisioning to scaling out, Dell's Infrastructure Automation automates each step, significantly reducing the complexity of operations and ensuring server configurations align with approved configuration profiles.
- Operational Intelligence: Aggregates metrics on server inventory, configuration, performance, and health across the network to enrich AI applications and reduce time spent on fault, performance, and configuration management.
- Multivendor Integration: Through custom plugins, Dell's Infrastructure Automation offers a unified approach to simplify configuration and updates of baremetal servers in multivendor server and multivendor CaaS environments to maximize supply chain flexibility.

Dell Telecom Infrastructure Automation Suite streamlines operations to deliver tangible economic benefits. Below is a detailed breakdown of these benefits:
Day 1 Operational Benefits:

- Automated Hardware Discovery and Configuration: Reducing physical setup time and potential for human error.
- Efficient Cloud Platform Deployment: Simplifying the deployment of CaaS platforms across vendors, such as Wind River and Red Hat, by automating the deployment of the CaaS management software.
- Ensures Hardware Prerequisites Are Met: Ability to integrate with a CSP's GitOps processes ensures hardware prerequisites are met prior to software deployment.

Day 2 Operational Benefits:

- Streamlined Integration and Testing: Integrating with a CSP's management systems to automate hardware updates and enable the use of modern CI/CD practices to accelerate time-to-market for new services.
- Automates System Scaling and Rebuilds: Automates the process of scaling out resources to meet capacity demands and system rebuilds to replace a failed system.
- Automates Detection and Remediation of Configuration Drift: Integration with a CSP's GitOps processes automates the detection and remediation server configuration drift.

- Advanced Management Capabilities: Providing rich telemetry from the servers to support AIOps enhances fault and performance management processes, leading to a more reliable and efficient network.

Dell Telecom Infrastructure Automation Suite not only reduces the time and expertise required to manage the infrastructure but also simplifies the process of moving to a horizontal cloud platform, which reduces CapEx through better infrastructure utilization.
The key economic advantages of this Infrastructure Automation are:

- Reduction in OpEx: Through automation, the suite significantly lowers labor costs and reduces the need for specialized engineering expertise.
- Decrease in CapEx: Better utilization of hardware resources based on the ability to move to a horizontal cloud platform, contributing to CapEx savings.
- Increase in Agility: An improved developer experience that supports modern CI/ CD practices results in faster deployment of new services, leading to improved responsiveness to market demands.

TCO Model Assumptions

A TCO model using the ACG Business Analytics Engine (BAE) compares two scenarios:

1. Without Dell Telecom Infrastructure Automation Suite: The PMO uses custom integrations and scripts that are maintenance intensive and expertise dependent to ensure server hardware aligns with configuration requirements in multivendor server and CaaS environments.
2. With Dell Telecom Infrastructure Automation Suite: Future mode of operations introduces a common hardware automation layer that integrates with a CSP's management systems to automate discovery, deployment, and updates of sever hardware in multivendor server and CaaS environments.

OpEx Labor Savings Assumptions
Dell Telecom Infrastructure Automation Suite provides labor (OpEx) savings due to the benefits described previously in this paper. The details of the TCO model assumptions for Day 1 and Day 2 OpEx savings are presented in Table 1 and Table 2, respectively.

Tasks	Description	Dell Telecom Infrastructure Automation Suite Benefits	Current Labor Hours Required	Estimated Savings with Dell's Infrastructure Automation
Hardware Setup and Upgrades	Automates discovery and uses declarative automation to update hardware settings such as BIOS, NIC firmware, RAID configurationsfor Dell and third-party servers to align with defined configuration profiles in Git. Third- party servers require development and maintenance of a custom plugin. Integrates with CICD processes to enable the delivery of infrastructure-as-code. This automated process also simplifies cloud platform installation by ensuring hardware prerequisites are met prior to installation of the cloud platform software.	Utilizes declarative automation and GitOps integrations to reduce the time spent on discovering server configurations and updating configurations to align with approved configuration profiles. Simplifies cloud platform software installation by ensuring prerequisites are met.	5 hours per server per year	80%
Network Testing	Dell Telecom Infrastructure Automation Suite integrates with CI/CD processes to ensure server configuration aligns with Git as the single source of truth for the full hardware and software stack. It also automates updates to enable modern development and deployment practices such as canary deployments with rollback to simplify network testing processes.	This reduces time spent on end-to-end testing processes by ensuring the full hardware and software stack align with a CSP's single source of truth in Git and enables proven methodologies for rolling out hardware/software updates. When integrated with GitOps tools such as with Argo Cd, it can automate rollback of hardware configurations as needed.	5 hours per server per year	50%

Table 1. Key Areas of Day 1 Labor Savings due to Dell Telecom Infrastructure Automation Suite

Tasks	Description	Dell Telecom Infrastructure Automation Suite Benefits	Current Labor Hours Required	Estimated Savings with Dell's Infrastructure Automation

Fault & Performance Management	Integration with GitOps tools like Argo Cd detect and automate remediation of configuration drift. Dell Telecom Infrastructure Automation Suite automates rebuild processes to support restoration of services after a failed component or system. Federated architecture collects telemetry data for Dell and third-party servers, maps data to infrastructure components, and uses open APIs to integrate with a CSP's AIOps applications to streamline fault and performance troubleshooting processes and proactively discover issues before they become a problem.	Ensuring configuration alignment with approved profiles in Git reduces configuration errors that lead to performance and fault issues. The ability to rapidly restore systems reduces time spent on remediating faults due to system failures. Rich data collection enables CSP AIOps applications to proactively detect service issues before they become a problem and helps troubleshoot issues that do occur.	30 hours per server	80%
Configuration Management	Automates discovery and maintains an up to date view of all server configurations in the environment. Declarative automation ensures a consistent deployment or update of the hardware that aligns with Git as the single source of truth. Reduces time spent on performing updates which minimizes the window required to perform updates to simplify planning and execution of system updates. When integrated with Argo Cd, it can automate the detection and remediation of configuration drift.	Reduces time spent on planning and executing configuration updates. Reduces time spent ensuring the network infrastructure aligns with approved configuration profiles.	5 hours per server per year	80%

Application Development	Accelerates development by enabling delivery of infrastructure as code. It supports modern development practices such as continuous design and integration with canary deployments. APIs and SDK enable Dell Services, a Systems Integrator or internal engineering team to integrate the suite with higher level management and orchestration applications to enable zero touch provisioning. Automates the creation of clones to support application development.	Eliminates friction that inhibits developers from building and updating their environment to reflect the required configuration profile. It also allows them to use modern DevOPs practices such as GitOps to accelerate application development velocity.	10,400 hours per year (10,400 = 5 developers)	10%

Table 2. Key Areas of Day 2 Labor Savings due to Dell Telecom Infrastructure Automation Suite

Network Architecture Assumptions

Our model uses a 5G core network with 50 million subscribers. We assume that the subscribers migrated to the 5G core over five years. We model the 5G control plane and user plane (UPF). We also assume that average peak traffic per subscriber is 800 Kbp s with an annual growth rate of 20%.

The average pe ak traffic drives the 5G control plane and UPF, which in turn drives the number of servers required.

We also assume that the scenario without Infrastructure Automation uses a vertical stack architecture while the scenario with Infrastructure Automation uses a horizontal stack architecture where all hardware resources are shared among multiple applications.

In a vertical architecture the CNF vendor provides or specifies the configuration of all components of the stack including:

- 5G core software
- Cloud software (Kubernetes and/or VIM)
- Bare-metal layer (compute, networking, and storage)

These vertical stacks do not allow sharing of servers and other resources, which leads to poor resource utilization that directly results in increased CapEx and OpEx. Underutilization of servers leads to many additional expenses:

- Increased server CapEx
- Increased power and cooling expenses
- Increased CO_2 emissions
- Increased cloud software expenses (priced per server)
- Increased floorspace expenses
- Increase labor expenses

Underutilization occurs because vertical stacks are frequently overprovisioned to ensure that demand never exceeds server capacity.

A horizontal cloud-native architecture provides a single cloud platform for all applications running on all servers. It is a requirement for a flexible network solution and cloud service agility. Horizontal networks have multiple

benefits:

- Better server utilization, which reduces CapEx and OpEx
- Reduced power consumption and CO_2 emissions
- Sharing of compute resources between many vendors' CNFs and applications
- An agile and scalable network architecture to support the rollout of new services
- Synergy between telecom and IT infrastructure

Based on its work with dozens of Tier 1 and Tier 2 CSPs, ACG Research estimates that CSPs with these vertical stacks can improve server utilization rate by 15% or more by moving to a horizontal cloud platform.

Dell Telecom Infrastructure Automation Suite TCO Savings

Our TCO model calculated the TCO for both scenarios:

1. Without Infrastructure Automation Suite
2. With Infrastructure Automation Suite

The results of our TCO scenario comparison are summarized in Table 3.

	Without the Automation Suite	With the Automation Suite	Savings	ROI
Five-Year Cumulative TCO	$27.94 Million	$22.47 Million	$5.47 Million 20%	249%
Five-Year Cumulative OpEx	$16.75 Million	$12.94 Million	$3.8 Million 23%	N/A
Five-Year Cumulative CapEx	$11.19 Million	$9.52 Million	$1.67 Million 15%	N/A

Table 3. Comparison of Two Scenarios: Without and with Dell Telecom Infrastructure Automation Suite

A detailed breakout of the OpEx savings for Infrastructure Automation is provided in Figure 2. The savings are ranked highest to lowest. Savings are a result of the OpEx benefits of Dell's Infrastructure Automation and the benefits of the horizontal architecture, which reduces the number of servers required by an estimated 15%. The additional OpEx expenses for Infrastructure Automation are due to the annual software licenses.

An annual OpEx comparison of the two scenarios is provided in Figure 3, and an annual CapEx comparison is provided in Figure 4.
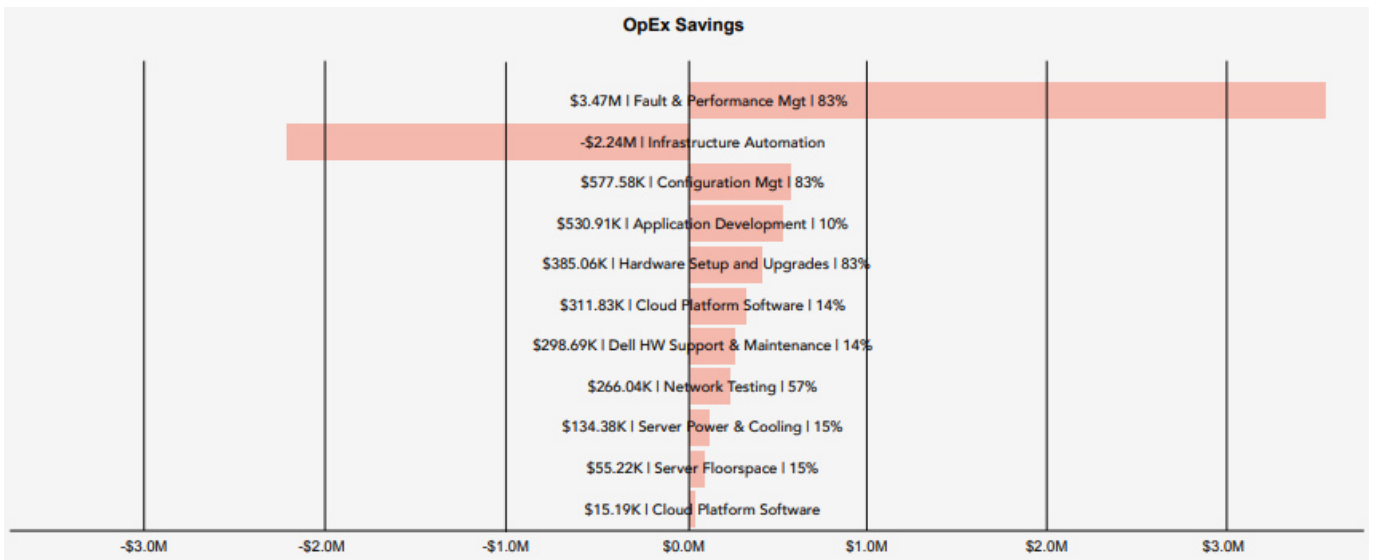
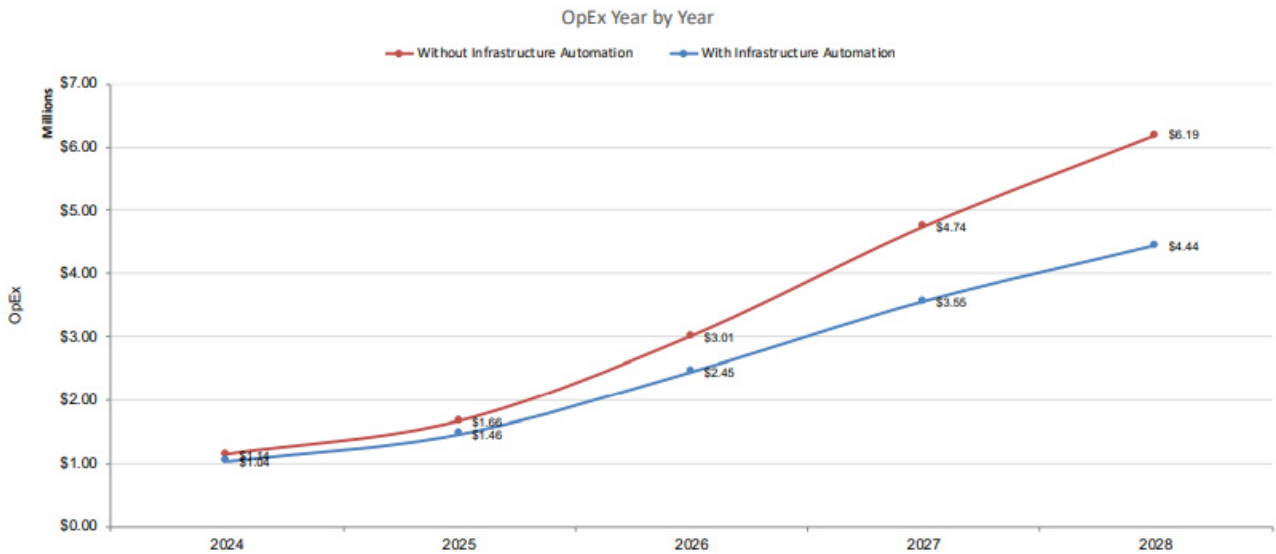**Figure 3. Breakdown of OpEx Savings for Dell Telecom Infrastructure Automation Suite**

Figure 4: Annual OpEx Comparison with and without Dell Telecom Infrastructure Automation Suite for 50 Subscribers on 5G
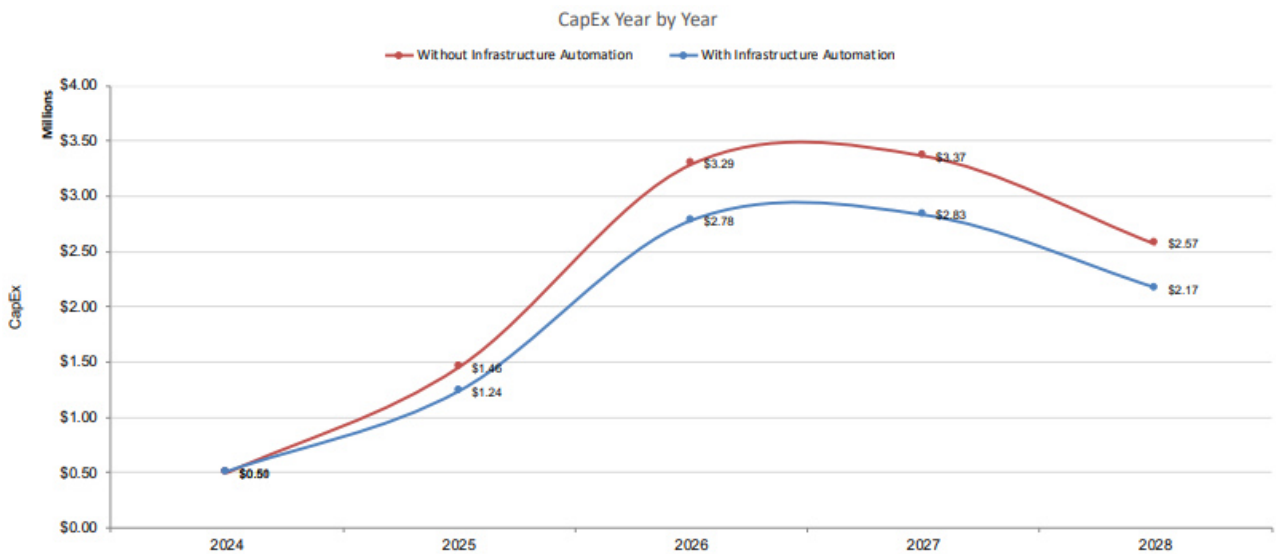

Figure 5. Annual CapEx Comparison with and without Dell Telecom Infrastructure Automation Suite for 50 Million Subscribers on 5G

Conclusion

The adoption of Dell's Telecom Infrastructure Automation Suite marks a transformative step towards operational excellence in the telecom sector. Our comprehensive analysis using the ACG Business Analytics Engine

demonstrates that the Dell Telecom Infrastructure Automation Suite not only mitigates the complexities associated with present infrastructure management practices but also delivers considerable economic benefits.

The automation and life-cycle management capabilities of Dell Telecom Infrastructure Automation Suite contribute to a significant reduction in OpEx, primarily by decreasing labor costs and the need for specialized expertise. The horizontal stack architecture capitalizes on improved server utilization, leading to CapEx savings and a more sustainable operational model marked by reduced power consumption and CO_2 emissions.

The TCO model underscores a clear economic incentive: a projected 20% ROI and a cumulative savings of $5.47 million over five years. These savings are a testament to the efficacy of the suite in fostering an agile, efficient, and future-ready telecom infrastructure.

In the rapidly evolving telecom landscape, the shift toward automated, scalable, and flexible infrastructure management is not merely advantageous; it is imperative. Dell Telecom Infrastructure Automation Suite emerges as a pivotal solution that not only enhances operational workflows but also aligns with the economic and strategic objectives of modern telecom service providers.

Peter Fetterolf

Peter Fetterolf, Ph. D. is an expert in network technology, architecture and economic analysis. He is responsible for financial modeling and whitepapers as well as software development of the ACG Research Business Analytics Engine. Dr.

Fetterolf has a multidisciplinary background in the networking industry with over thirty years of experience as a management consultant, entrepreneur, executive manager, and academic. He is experienced in economic modeling, business case analysis, engineering management, product definition, market validation, network design, and enterprise, and service provider network strategy.

Documents / Resources
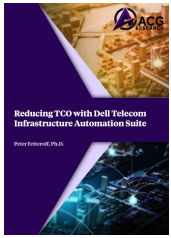
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References

- **[User Manual](#)**